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ABSTRACT

A research project underway at the University of Arizona is described, and the usefulness of the national data system of the Higher Education General Information Survey (HEGIS) to institutional researchers, as well as some drawbacks of the system, are considered. The need for institutions to have data on enrollment, budgets, and faculty/students that can be compared to other schools is noted. Technical and operational problems of HEGIS data tape use are examined and statistical tables illustrating the difficulties are included. An advantage of the HEGIS system is that data can be compared within any given year and, in many cases, longitudinally. The use of national data sources in building models to illuminate enrollment trends and isolate associated variables is illustrated by a University of Arizona project that was designed to formulate disaggregated national, regional, and state enrollment forecasts by enrollment-change categories and by institutional classification. The role of economic, societal, and institutional variables in enrollment trends is another focal area. The files for accomplishing this project have been assembled from HEGIS, Office of Education, and Census Bureau data. (SW)

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Uses of National Data Systems by Institutional Researchers: Implications for the 1980's

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THE ASSOCIATION FOR INSTITUTIONAL RESEARCH

This paper was presented at the Twentieth Annual Forum of the Association for Institutional Research held at the Peachtree Plaza Hotel in Atlanta, Georgia, April 27 - May 1, 1980. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum papers.

Mary Corcoran
University of Minnesota
(Editor, AIR Forum Publications)

Higher education in the 70's has lost status in terms of public and, in some instances, financial support. Trends of accountability, retrenchment, and austerity which started in the 70's will continue in this decade, Glenny (1979, pp. 41-42). These trends coupled with a predicted decline in enrollments cause Glenny (1979, pp. 35-36) and Parker (1977) to suggest that the problems of the 1970's are not likely to improve much in the 1980's. Since legislative, gubernatorial and coordinating board budget staff in many states are building data bases for comparative and evaluative uses, institutional researchers need data sources with which to evaluate these findings and their interpretations for their own institutions. Such sources must provide accurate, reliable, and comparable data from which an institutional researcher can extract information about comparable institutions. One such source is the Higher Education General Information Survey (HEGIS) sponsored by the National Center for Education Statistics (NCES).

The HEGIS survey collects a wide variety of data from most institutions in the United States, both public and private. Information collected includes enrollment, financial, physical facility, degree, and employee data. Most, but not all, of these categories are collected annually. All are useful for comparative purposes and can provide information in those areas most likely to come under scrutiny in a period of budgetary retrenchment.

These data are provided by NCES on public use data files in machine readable form on a timely basis, approximately a year after collection, and at a reasonable cost. Several of the older files take longer to acquire than the more recent releases because some information on individuals has to be suppressed to meet the privacy requirements of legislation passed since the data were originally collected. Older employee tapes containing individual

salaries are an example. Some of these data are available in printed form about the same time as the computerized data, e.g., enrollments and degrees conferred.

For those agencies or institutions planning to build a data base for comparative purposes, using the HEGIS data tapes as a source, some caveats are in order regarding the technical and operational problems involved in the processing of HEGIS data in magnetic tape form.

Technical Problems of HEGIS Data Tape Use

There are three major technical problems that make computer processing of HEGIS data tapes difficult for some users: the recording format of some of the numeric information on the tapes, the documentation of the tapes, and the record format used for a logical record on the tapes.

Several of the HEGIS files are available only in an Extended Binary Coded Decimal Interchange Code (EBCDIC) packed format. Data recorded in this format cannot be used on some computer systems and even if acceptable to the system may cause problems with some programming languages, FORTRAN for instance. At the University of Arizona this type of data must first be unpacked through the use of a utility program before useful computing can be accomplished. This process unpacks the packed fields in each record and creates a new, unpacked version of the file. Some of the HEGIS data tapes are available in either packed or unpacked EBCDIC. Requests for unpacked versions may cause a delay in delivery, but are compensated for by ease of processing.

Documentation is always a problem when working with a file created by another agency. Some HEGIS tapes come very well documented while others do not. The minimum documentation that has accompanied a tape purchased by the

Center for the Study of Higher Education at the University of Arizona consisted of a copy of the original survey instrument and a record layout form. The record layout form has always been a photocopy, and some are difficult to read. For example, the names of the fields on these forms are usually hand written and sometimes will give no information regarding either the coding schemes used to encode the responses to checkoff items from the original instrument or certain fields in the header information supplied with each record on the tape. The better documented data tapes come with the above documentation and a data element description which contains the field name, data element type, record position, and a description of the contents of field for each field on the tape; on occasion these descriptions refer to tables of possible values for the data items which are not supplied with the documentation. These problems can be solved, but it would be much easier on the user if the quality of the documentation was higher and more consistent.

The tapes as received from NCES seem to be edit tapes and, as such, contain much redundant information. An institutional entry on a file will sometimes require several records for its responses to a given survey form, one record for each line of the survey for which the institution had a non-zero or non-blank response. Each of the records has a seventy character header which includes such items as the Federal Interagency Committee on Education (FICE) code, institution name, and other data apparently used by NCES. Additionally, there is always some trailer information which certains, among other items, several flags indicating imputed or changed values for the data fields. Record length within a file is always the same for the HEGIS files. Typically these records vary in length among the various files from 170 characters for the employee files to 244 characters for the enrollment

files. The actual survey data never account for more than half the record.

This method of recording the data can cause some unnecessary programming difficulties since the part and line numbers must always be supplied when extracting data from the file. The problem can be solved by merging all the data records for an institution from the NCES tapes into a single record, with header, for each institution. In using this type of file, all that need be specified to extract some information about an institution is the FICE code and the names of the variables needed. Smaller working files are much easier to create from this revised record format than from the original NCES format.

Operational Problems of HEGIS Data Tape Use

Perhaps one of the most difficult problems to overcome in using the HEGIS files is the low esteem in which these data are held in some quarters. These data probably suffer no more nor less from reporting and recording errors than do any other data that can be used for comparative purposes. In some states the HEGIS data are used for state as well as federal reporting purposes, and this is probably as good a data source as is likely to be found for comparative purposes.

Another problem is the lack of consistency in the definitions and types of data items collected by the HEGIS surveys from year to year. Tables 1 through 3 exhibit the types of data elements available in the HEGIS employee and finance files for the years 1972 through 1978 and in the enrollment files from 1965 through 1979. An examination of the data elements collected over the period of years covered by these tables reveals this lack of consistency. Since 1975 (1976 for the enrollment files), however, the data elements collected by HEGIS have been consistent; elements have been added in some years

Table 1. HEGIS Categories of Enrollment Data, 1965-1978

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
I. DEGREE CREDIT														
A. Resident														
1. Undergraduate														
a. Lower Division					S	S	S	S						
b. Upper Division					S	S	S	S						
Total-Undergraduate			S		S	S	S	S						
2. First-Professional					S	S	S	S						
3. Graduate			S		S	S	S	S						
4. Unclassified					S	S	S	S						
Total-Resident		S			S	S	S	S						
B. Extension														
1. Undergraduate					SP	SP	SP	SP						
2. First-Professional/Graduate					SP	SP	SP	SP						
3. Unclassified					SP	SP	SP	SP						
Total-Extension		S	SP		SP	SP	SP	SP						
C. Resident and Extension														
1. Undergraduate														
a. Lower Division									S	S	S	X	X	X
b. Upper Division									S	S	S	Y	Y	Y
Total-Undergraduate				S					S	S	S	SCRT	SC	SCRT
2. First-Professional									S	S	S	SCRT	SC	SCRT
3. Graduate				S					S	S	S	SCRTG	SCTG	SCRTG
4. Unclassified									S	S	S	SCRTU	SCTU	SCRTU
Total-Resident and Extension	S	S	S	S	S	S	S	S						
D. First Time Degree Credit														
Total-First Time Degree Credit	S	S	S	S		S	S	S	S	S	S	SCRT	SC	SCRT
II. NON-DEGREE CREDIT														
A. Resident					S	S	S	S						
B. Extension					SP	SP	SP	SP						
C. Resident and Extension	S			S	S	S	S	S	S	S	S			
D. First Time Non-Degree Credit				S		S	S	S	S	S	S			
III. GRAND TOTAL					S	S	S	S	S	S	S	S	S	S

C - Combined degree credit and non-degree credit
G - Graduates categorized by first-year and beyond the first year
P - Part-time data only
R - Classified by race: Non-resident alien, Black Non-Hispanic, American Indian or Alaskan Native, Asian or Pacific Islander, Hispanic, White Non-Hispanic
S - Data separated by sex
T - Classified by type of program: Agriculture and Natural Resources, Architecture and Environmental Design, Biological Sciences, Business and Management; Engineering, Dentistry, Medicine, Veterinary Medicine, Law, Physical Sciences, All Other
U - Unclassified categorized by undergraduate level and postbaccalaureate level
X - Lower division categorized by first-time freshmen, other first-year, and second-year
Y - Upper division categorized by third-year and fourth-year and beyond

NOTE: If space is blank, category is not available. All categories separated by full- and part-time except where noted.

Table 2. HEGIS Categories of Employee Data, 1972-1978

	1972-73	1974-75	1975-76	1976-77	1977-78	1978-79
Employees by Program Function and Occupational Activity - Number full-time, number part-time, and total FTE	A D by C					
Employees by Manpower Resource Category - Number full-time, number part-time, and FTE of part-time				A E by A		
Salaries of Full-time Faculty on 9 Month Contracts - Number in salary category	A[a] H by F			A I by F	A I by F	A J by F
Salaries of Full-time Faculty on 12 Month Contracts - Number in salary category	A[a] H by F			A I by F	A I by F	A J by F
Salaries of Full-time Faculty on Other Specified Contracts - Number in salary category	A H by F					
Salaries and Tenure of Full-time Instructional Faculty on 9-10 Month Contracts - Number of persons, mean salary, number with tenure		A F by A	A F by A			
Salaries and Tenure of Full-time Instructional Faculty on 11-12 Month Contracts - Number of persons, mean salary, number with tenure		A F by A	A F by A			
Salaries and Tenure of Full-time Instructional Faculty on 9 Month Contracts - Number of persons, total salary outlay, number with tenure, and number of contributing service or military				A F by A	A F by A	A F by A
Salaries and Tenure of Full-time Instructional Faculty on 12 Month Contracts - Number of persons, total salary outlay, number with tenure, and number of contributing service or military				A F by A	A F by A	A F by A
Salaries for Continuing Faculty on 9 Month or 12 Month Contracts Separately - Number of full-time faculty in current year remaining from previous year, current year total salary for continuing faculty, and previous year total salary for continuing faculty					B, F	B, F
Fringe Benefits for Full-time Faculty on 9-10 Month Contracts - Total expenditure and number covered	B G by F		B G by F	B G by F	B G by F	B G by F
Fringe Benefits for Full-time Faculty on 11-12 Month Contracts - Total expenditure and number covered	B G by F		B G by F	B G by F	B G by F	B G by F
Fringe Benefits for Full-time Faculty on Other Specified Contracts - Total expenditure and number covered	B G by E					

[a]The definition of the length of contract is slightly different from the definition used in 1976-77 and later years.
NOTE: If space is blank, category is not available. Definitions for categories represented by A through J are on the following page.

Table 2 (Continued)

A. Men and Women separately.

B. Men and Women combined.

C. Program Function Categories: 1) Instructor, 2) Organized Research, 3) Public Service, 4) Academic Support, Student Services, and Institutional Support.

D. Occupational Activity Categories: 1) Executive, Administrative, Managerial, 2) Instructors and Faculty, 3) Teaching Assistants and Associates, 4) Professional other than 1, 2, or 3, and 5) Non-professionals.

E. Manpower Resource Categories: 1) Executive, Administrative, Managerial, 2) Instruction/Research, 3) Instruction/Research Assistants, 4) Specialist/Support, 5) Nonprofessionals (no male/female classification).

F. Academic Rank Categories: 1) Professors, 2) Associate Professors, 3) Assistant Professors, 4) Instructors, 5) Lecturer, 6) Undesignated Rank.

G. Fringe Benefit Categories: 1) Retirement Plans (Other than Social Security) Vested and Not Vested, 2) Hospitalization, Surgical, and Medical, 3) Guaranteed Disability Income Protection, 4) Tuition Plan, 5) Housing Plan, 6) Social Security Taxes, 7) Unemployment Compensation Taxes, 8) Group Life Insurance, 9) Workmans Compensation, 10) Other Benefits in Kind with Cash Options.

Table 2 (Continued)

H. Salary Range Categories: 1) $42,000 and above, 2) through 10) $41,999 to $20,000 in $2,000 decrements, 11) through 20) $19,999 to $10,000 in $1,000 decrements, 21) through 30) $9,999 to $5,000 in $500 decrements, 31) Below $5,000

I. Salary Range Categories: 1) $40,000 and over, 2) through 11) $39,999 to $30,000 by $1,000 decrements, 12) through 59) $29,999 to $6,000 by $500 decrements, 60) Below $6,000.

J. Salary Range Categories: 1) $50,000 and over, 2) through 26) $49,999 to $25,000 by $1,000 decrements, 27) through 59) $24,999 to $8,500 by $500 decrements, 60) Below $8,500.

Table 3. HEGIS Categories of Institutional Financial Data, 1972-1978

	1972	1973	1974	1975	1976	1977	1978
PART A-CURRENT FUND REVENUES BY SOURCE	X	X	X	X	X	X	X
1. Educational & General Revenues				AI	AI	AI	AI
2. Student Aid Grants				N	N	N	N
3. Major Service Programs				A	A	A	A
4. Auxiliary Enterprises				A	A	A	A
5. Total Current Fund Revenues				A	A	A	A
PART B-CURRENT FUND EXPENDITURES	X	X	X	X	X	X	X
1. Educational & General Expenditures				A	A	A	A
2. Student Aid Grants				AI	AI	AI	AI
3. Major Service Programs				A	A	A	A
4. Auxiliary Enterprises				A	A	A	A
5. Total Current Funds Expenditures				A	A	A	A
PART C-PHYSICAL PLANT ASSETS	X	X	X	X	X	X	X
1. Land							
2. Buildings				C	C	C	C
3. Equipment							
PART D-INDEBTEDNESS ON PHYSICAL PLANT	X	X	X	X	X	X	X
				D	D	D	D
PART E-ENDOWMENT BY BOOK AND MARKET VALUE, EARNINGS, & REALIZED GAINS (CALLED DETAILS OF ENDOWMENT AFTER 1974)	X	X	X	X	X	X	X
				E	E	E	E
PART F-STATEMENT OF CHANGES IN FUND BALANCES	N	N	N	X	X	X	X
				F	FI	FI	FI
PART G-PUBLIC INSTITUTIONS ONLY (CALLED PART F BEFORE 1975)	X	X	X	X	X	X	X
1. Revenues				G	G	G	G
2. Expenditures				G	GJ	GK	G
3. Debt Outstanding, Issued, and Retired							
4. Cash & Security Holdings							

X - All categories available except where noted
A - Changed in 1975 to coincide with standard financial reporting
C - Includes line for estimated replacement cost of buildings
D - Includes a line for amount expended on interest
E - Includes more information on endowment holdings than does pre-1975 Part E
F - Category describes flow of all funds within the institutions
G - Used to collect Bureau of Census data after 1974
I - Includes separate entries for restricted and unrestricted
J - Personal services reported in this year
K - Employer contribution to employee benefits reported in this year
N - Data not collected in these years

but the basic elements have remained virtually unchanged over this period.

Liquidations, mergers, and the creation of branch campuses all have an impact on comparability of data from year to year. Creation of independent institutions from branch campuses and changes in the missions of some schools also cause problems when HEGIS data are compared longitudinally. Non-response to HEGIS questionnaires as well as anomalous data for a year or period of years must be remedied for some institutions before the HEGIS files can be used. Solutions for these problems with respect to the opening fall enrollment files are discussed in detail in Brown, Grant, and Leslie (1979, pp. 1-3). The techniques described consist mainly of contacting the institutions for critical data items and, if this fails, applying reasonable interpolations or extrapolations to fill in missing data. Similar techniques should also be applicable to the employee and finance files.

Comparative Uses of HEGIS Data

One of the strongest arguments that can be made in support of an institutional budget or capital outlay request is the argument that the institution is in an unfavorable position with respect to some critical measurement when compared to similar institutions. The critical measurement may be the amount of the educational and general fund or the instructional fund expended per full-time-equivalent student (FTSE), the amount expended for student services per FTSE, the number of full-time faculty at a given rank earning more or less than the median salary for that rank at similar institutions, or any of a host of other measures. Such arguments will be particularly persuasive if the data show the unfavorable condition to have prevailed for a period of time and especially persuasive if a negative trend is exhibited.

HEGIS data can be used to provide the substance for such arguments. In the first measurement proposed above, the finance files can provide the requisite figures for the amounts expended for instruction and related activities while the enrollment files would provide the full- and part-time student headcounts necessary to calculate FTSE. The employee files can supply data to support arguments involving full-time faculty salaries as illustrated above. It is recognized that other sources of data are available for these purposes, however, the HEGIS data are comprehensive in terms of the number and type of institutions covered and consistent within any given year's data in terms of the definition of data elements. This allows comparability of data within any given year and, in many cases, longitudinally.

Choice of comparative institutions is critical to arguments of this nature. Size, location, type, and tradition are all considerations that must be taken into account when comparable institutions are selected. HEGIS files offer a wide range of selections in this regard and makes them particularly valuable for these purposes.

University of Arizona Enrollment Projection Project

A project now under way at the University of Arizona gives an example of the use national data sources such as HEGIS in building models to aid in the understanding of enrollment trends and the isolation of variables associated with these trends. The purpose of this project is to formulate disaggregated national, regional, and state enrollment forecasts by enrollment-change categories and by institutional classification, using the 1976 Carnegie Commission Classification of Institutions, and to determine the part various economic, societal, and institutional variables play in enrollment trends. These

disaggregated trends along with appropriate known and forecasted variables will be used to construct models for the nation, regions, states, and individual institutions.

The files for accomplishing this project have been assembled and consist of HEGIS, Office of Education, and Census Bureau data. Three phases utilizing the data base will be required to provide the projection models: analyses of enrollment trends, assessment of the predictive validity of variables, and development of suitable models.

In the first phase, detailed descriptive analyses of enrollment trends will be developed and each institution will be categorized by the pattern of enrollment trend it best fits. The eight patterns to be considered initially are 1) stable enrollments, 2) constant growth, 3) accelerated growth, 4) slowing growth, 5) constant decline, 6) accelerated decline, 7) slowing decline, and 8) erratic enrollments. This will be accomplished for the period 1965 to 1978, which is an extremely interesting and important time span because it includes not only the peak growth period of higher education but the beginning of the slow down and decline in enrollments at many institutions.

Phase two will assess the predictive validity of variables for each of the enrollment patterns. Multiple regression and multivariate analysis will be applied to determine institutional characteristics and variables that explain significant portions of the variance from trends within the enrollment and Carnegie classifications described above. The following variables are typical of those that will be tested: 1) Control, i.e., public, private, religious; 2) Geographical location including within or without a Standard Metropolitan Statistical Area (SMSA); 3) State and local unemployment rates;

4) Institutional expenditures per student; 5) Average student charges for in- and out-of-state; 6) Percentage of part-time students; 7) Percentage of state or SMSA population in various age categories; 8) State and local population increase or decrease.

In the development of this phase, several computer models that best describe past enrollment patterns will be built using the enrollment trend classifications and the significant variables developed in the second phase described previously. Different models will be constructed for national, state, and institutional projections.

National Models. All institutions will be grouped according to their past enrollment experiences and institutional type (Carnegie Classification). The enrollments of institutions classified in each of the eight enrollment patterns will be extended for one, five, and ten years as they are modified by actual and projected variables developed in the second phase. For example, if the increasing size of the 25 to 55 age group appears to significantly affect the enrollments of urban two-year colleges with slowing growth, this impact will be used to modify the rate of slowing growth for this subclassification. Similarly enrollments at non-urban, private institutions with religious control may be affected most strongly by high school graduation rates and increasing federal student aid. Measurement of the impact of these influences will permit modifications of the different enrollment trends different groups of such institutions may have exhibited in the past.

State Models. All institutions within a state will be grouped according to the enrollment trend patterns developed in phase one. Institutions may also be grouped according to institutional types and controls if these stratifications appear productive in assessing enrollment changes. Variables

considered to be significant for that state will be projected and applied to the enrollment trends of the institutions according to Carnegie Classification and enrollment trend classification. A one, five, and ten year projection for total enrollments will be made for the states by type and control of institution.

A rudimentary model built upon some of the principles described above was tested on the state of Pennsylvania in a projection by Dr. Larry L. Leslie (1976). A one year prediction using the model resulted in less than a one percent error.

Institutional Model. Institutional models will be developed for public and private institutions in each of the four Carnegie Commission Classifications listed below:

a. Doctoral granting institutions
b. Comprehensive universities and colleges
c. Liberal Arts Colleges
d. Two-year colleges and institutions.

Enrollment trends of the institutions will be modified by significant variables and projections of variables for a one, five, or ten year projection. In addition, information concerning institutional constraints will be obtained from the institutions by questionnaire and used to modify the enrollment trends and augment the variables described. Such limitations on enrollment as number of classrooms, number of dormitory rooms, faculty, class size, and program size will be determined and used in the model if these variables make a significant contribution to the predictive power of the model.

Summary and Conclusions

Fiscal problems developing in the late 1970's have produced many problems for the postsecondary education community. Calls for accountability on the part of public institutions have developed over the past several years. The decline in enrollments predicted for the 1980's will most likely exacerbate these problems. Forceful arguments must be made for continuing and expanding financial support for all institutions, both public and private. Sources of comparative data must be developed and used so that the quantitative aspects of these arguments can be made as strong as possible. Despite the problems outlined in this paper, HEGIS survey data provide a continuing, readily available source of comparative institutional data. Turning these data into useful information is limited only by the imagination and resourcefulness of the individual institutional researcher.

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